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(54) **High voltage relay**

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Relais haute-tension

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(73) Proprietor: **EEV LIMITED**
Chelmsford, Essex, CM1 2QU (GB)

(72) Inventor: **Rees, John Richard Will**
North Hykeham, Lincoln, LN6 8JL (GB)

(74) Representative: **Cockayne, Gillian et al**
GEC Patent Department
Waterhouse Lane
Chelmsford, Essex CM1 2QX (GB)

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Description

This invention relates to high voltage relay arrangements and more particularly to relay arrangements which are capable of switching large energies but which are inexpensive to manufacture.

Relay arrangements used in equipment such as medical defibrillators, for example, must be able to withstand large hold off voltages without arcing and capable of being switched quickly. One type of relay used at present includes contacts which are housed within an envelope of glass and metal which also contains an insulating gas at a relatively high pressure, typically in the region of three atmospheres. Such an envelope is expensive to fabricate because of the difficulties in providing good sealing between the glass and metal parts, particularly where electrical leads are taken out through the glass wall and because glass tends to be difficult to work.

A typical relay arrangement for use in defibrillators is shown in French Patent Application No. FR-A-2437219 in which a capacitor is charged and then discharged under control of a relay comprising a pair of switching arms each bearing a moving contact and rotating under the control of a rotary magnet and coil between the two sets of fixed contacts.

Another known type of relay envelope arrangement is shown in European patent applications nos. 0026231, 0130500 and 0118841 all of which show low voltage relay arrangements enclosed by plastic casings and/or plastic casings intended to enclose low voltage relay arrangements. It would not have been expected that such casings would be suitable for enclosing defibrillator relay arrangements such as that shown in FR-A-2437219.

US-A-4 039 984 describes a pressurized relay assembly which may operate at voltage of 100 volts to 30 kilovolts and be used in a DC defibrillator.

The present invention arose from an attempt to design a high voltage relay arrangement which is particularly suitable for use with medical defibrillators and which is relatively cheap to manufacture.

According to the invention there is provided a high voltage relay arrangement comprising fixed and movable contacts contained within a housing filled with electrically insulating gas at a pressure of approximately one atmosphere and characterised by the housing being wholly of plastic material. By using plastic material for the housing, the arrangement may be fabricated relatively cheaply, preferably using moulding techniques. Furthermore, the problems caused when materials having different coefficients of expansion are used in the envelope are reduced or avoided. The inventor has realised that, although a housing of plastic material may not be generally as strong as a conventional glass/metal construction, that by suitably configuring the contacts within the housing a lower pressure gas may be used whilst retaining satisfactory performance. The relay arrangement must be able to hold off in the region of 5.5

kV for use in defibrillator equipment and be capable of switching 500J. By using relatively large gaps between metal parts within the housing and having an insulating gas filling this may be achieved at relatively low gas pressures, enabling plastic to be used even in such a demanding application. It is preferred that the gas pressure within the housing is approximately one atmosphere, reducing stresses on the housing walls caused by differences between internal and external pressures.

The insulating gas used must be such that, unlike air, say, it does not readily conduct and if it has by-products then they must also be non-conductive. The particular plastic material used depends on its properties when it comes into contact with the insulating gas.

In one advantageous embodiment of the invention, the movable contact is pivoted at two pivot points. This enables a large amount of movement to be produced in a relatively short time. Thus, it is possible to space the movable and fixed contacts at fairly large distances apart to reduce the tendency for arcing to occur without significantly impairing the performance of the relay.

In one embodiment of the invention two sets of fixed and movable contacts are included and a member of electrically insulating material is located between the two sets, thus giving additional shielding against arcing. Preferably, the member is an actuator for moving the movable contacts, this being a particularly convenient configuration.

One way in which the invention may be performed is now described by way of example with reference to the accompanying drawings in which:

Figure 1 is a schematic sectional view of a relay arrangement in accordance with the invention;

Figure 2 is a schematic sectional view taken along the line II-II of Figure 1; and

Figure 3 is a schematic circuit diagram.

With reference to Figures 1 and 2, a relay arrangement used in medical defibrillator equipment includes two sets of contacts generally indicated at 1 and 2 respectively. Each set 1 and 2 of contacts includes two fixed contacts 3, 4, 5 and 6 and a movable contact 7 and 8. The sets 1 and 2 of contacts are located within a housing 9 which is of a plastic material and is cuboid, having rectangular faces. The housing 9 is filled with an insulating gas, at a pressure of approximately one atmosphere.

The contacts 3 and 4 of the first set 1 are mounted on a common post, the electrical connection to the lower contact 4 being made by a wire 10 and that to the upper contact 3 by a wire 11. Insulating material 12 is located between the contacts 3 and 4 and the wires 10 and 11 are also insulated. The movable contact 7 is pivoted at two points 13 and 14. The pivot point 14 at the end of the movable contact 7 remote from the fixed contacts 3

and 4 consists of a slot in a metal portion 15 of a post 16 through which the contact 7 passes. At the other pivot point 13, a cylindrical rod 17, attached to an actuator member 18 is located against the contact 7, the contact 7 including a curved part to accommodate the rod 17.

The second set 2 of contacts is substantially identical in configuration to the first set. The part of the actuator member 18 between the two sets is of electrically insulating material.

The housing 9 also includes a coil 19 which provides means for electromagnetically moving the actuator 18. Normally, the actuator 18 is held in the position shown in Figures 1 and 2, by a spring 20, the movable contacts 7 and 8 being in contact with the upper fixed contacts 3 and 5. When the coil 19 is energised, the actuating member 18 is moved downwardly and the movable contacts 7 and 8 come into contact with the lower fixed contacts 4 and 6.

The actuator member 18 comprises a horizontal part 21 as shown and a substantially vertical part 22. The vertical part 22 is arranged to extend sufficiently far that, when the member 18 is in its upper most position, the lower fixed contacts 4 and 6 are electrically shielded by it.

The base 23 of the housing 9 includes moulded portions 24 through which electrical connectors are taken. During manufacture of the relay arrangement, the coil 19 and contacts 1 and 2 are assembled on the base 23 and then the remainder of the housing sealed to the base 24. The housing 9 is then evacuated via a vent hole and the insulating gas pumped in.

With reference to Figure 3, a circuit arrangement which includes the relay arrangement of Figures 1 and 2 comprises a high voltage d.c. supply 25 connected across a capacitor 26 via the movable contacts 7 and 8 of the relay arrangement. The capacitor is also connected to paddles 27 and 28 which, in use, are held in contact with a patient who is being defibrillated.

In use, the high voltage d.c. supply 25 is switched on to charge the capacitor 26, the movable contacts 7 and 8 being in the position shown, when the required amounts of energy is stored, the operator triggers the arrangement and a voltage pulse is applied to the relay coil 19. This activates the relay so that the capacitor 26 is discharged via an inductor 29 across the paddles 27 and 28.

Claims

1. A high voltage relay arrangement comprising fixed (3, 4, 5, 6) and movable (7, 8) contacts contained within a housing (9) filled with electrically insulating gas at a pressure of approximately one atmosphere and characterised by the housing being wholly of plastic material.

2. An arrangement as claimed in Claim 1 wherein the

relay is connected in a circuit including a high voltage supply and means for applying a defibrillating pulse to a patient.

3. An arrangement as claimed in claim 1 or claim 2, wherein the housing is a hollow cuboid.

4. An arrangement as claimed in any one of claims 1 to 3 wherein the moveable contact (7, 8) is arranged to move between two fixed contacts (3 and 4, 5 and 6).

5. An arrangement as claimed in any preceding claim wherein the movable contact is pivoted at two pivot points (13, 14).

6. An arrangement as claimed in any preceding claim and including electromagnetic means (19) for moving the movable contact.

7. An arrangement as claimed in any preceding claim and including two sets (1, 2) of fixed and movable contacts and a member of electrically insulating material (18) located between the two sets.

8. An arrangement as claimed in claim 7 wherein the electrically insulating member is an actuator for moving the movable contacts.

9. An arrangement as claimed in any preceding claim wherein the housing is of moulded construction.

10. An arrangement as claimed in claim 9 wherein the housing includes moulded lead-through portions through which electrical conductors are passed.

Patentansprüche

1. Eine Hochspannungsrelaisanordnung mit festen (3, 4, 5, 6) und bewegbaren (7, 8) Kontakten, die in einem Gehäuse (9) enthalten sind, das mit elektrisch isolierendem Gas bei einem Druck von näherungsweise einer Atmosphäre gefüllt ist, und die dadurch gekennzeichnet ist, daß das Gehäuse vollständig aus Kunststoffmaterial besteht.

2. Eine Anordnung wie in Anspruch 1 beansprucht, worin das Relais in einen Schaltkreis geschaltet ist, der eine Hochspannungszufuhr und Mittel zum Anlegen eines Defibrillationspulses an einen Patienten umfaßt.

3. Eine Anordnung wie in Anspruch 1 oder Anspruch 2 beansprucht, worin das Gehäuse ein hohler Quader ist.

4. Eine Anordnung wie in einem der Ansprüche 1 bis

3 beansprucht, worin der bewegbare Kontakt (7, 8) so ausgelegt ist, daß er sich zwischen zwei festen Kontakten (3 und 4, 5 und 6) bewegt.

5. Eine Anordnung wie in einem der vorhergehenden Ansprüche beansprucht, worin der bewegbare Kontakt an zwei Drehpunkten (13, 14) angelenkt wird.

6. Eine Anordnung wie in einem der vorhergehenden Ansprüche beansprucht, welche elektromagnetische Mittel (19) zum Bewegen des bewegbaren Kontaktes enthält.

7. Eine Anordnung wie in einem der vorhergehenden Ansprüche beansprucht, welche zwei Sätze (1, 2) von festen und bewegbaren Kontakten und ein Glied aus elektrisch isolierendem Material (18) enthält, das zwischen den zwei Sätzen angeordnet ist.

8. Eine Anordnung wie in Anspruch 7 beansprucht, worin das elektrisch isolierende Glied ein Aktuator zum Bewegen der bewegbaren Kontakte ist.

9. Eine Anordnung wie in einem der vorhergehenden Ansprüche beansprucht, worin das Gehäuse eine gegossene Konstruktion ist.

10. Eine Anordnung wie in Anspruch 9 beansprucht, worin das Gehäuse gegossene Durchleitungsteile enthält, durch welche elektrische Leiter geführt sind.

pivote au droit de deux points de pivotement (13, 14).

6. Agencement selon l'une quelconque des revendications précédentes, et comprenant un moyen électromagnétique (19) pour déplacer le contact mobile.

7. Agencement selon l'une quelconque des revendications précédentes, et incluant deux ensembles (1, 2) de contacts fixes et mobiles et un élément fait d'une matière isolante de l'électricité (18) situé entre les deux ensembles.

8. Agencement selon la revendication 7, dans lequel l'élément isolant de l'électricité est un actionneur pour déplacer les contacts mobiles.

9. Agencement selon l'une quelconque des revendications précédentes, dans lequel le boîtier est une structure moulée.

10. Agencement selon la revendication 9, dans lequel le boîtier comprend des parties moulées formant des traversées par lesquelles on fait passer des conducteurs électriques.

Revendications

1. Agencement de relais à haute tension comprenant des contacts fixes (3, 4, 5, 6) et mobiles (7, 8) contenus à l'intérieur d'un boîtier (9) rempli d'un gaz isolant de l'électricité à une pression d'environ une atmosphère, et caractérisé en ce que le boîtier est entièrement fait de matière plastique.

2. Agencement selon la revendication 1, dans lequel le relais est connecté à un circuit comprenant une alimentation à haute tension et un moyen pour appliquer une impulsion de défibrillation à un patient.

3. Agencement selon la revendication 1 ou la revendication 2, dans lequel le boîtier est un parallélogramme rectangle creux.

4. Agencement selon l'une quelconque des revendications 1 à 3, dans lequel le contact mobile (7, 8) est conçu pour se déplacer entre deux contacts fixes (3 et 4, 5 et 6).

5. Agencement selon l'une quelconque des revendications précédentes, dans lequel le contact mobile



